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(54) Valve assembly with cleaning means

(57) In a valve assembly for closing and sealing an inlet (5) which is full of granular material the valve closure member is in the shape of a part of a spherical shell mounted for rotation between open and closed positions and is provided with a flexible film or skin (19) overlying at least part of its convex surface (9), the film or skin being deformable in order to dislodge material adhering thereto. The film (19) is preferably elastomeric and is deformed by compressed air supplied through ducts (25, 27). An annular seal ring cooperating with the closure member may be supplied with compressed air through a bore (15).

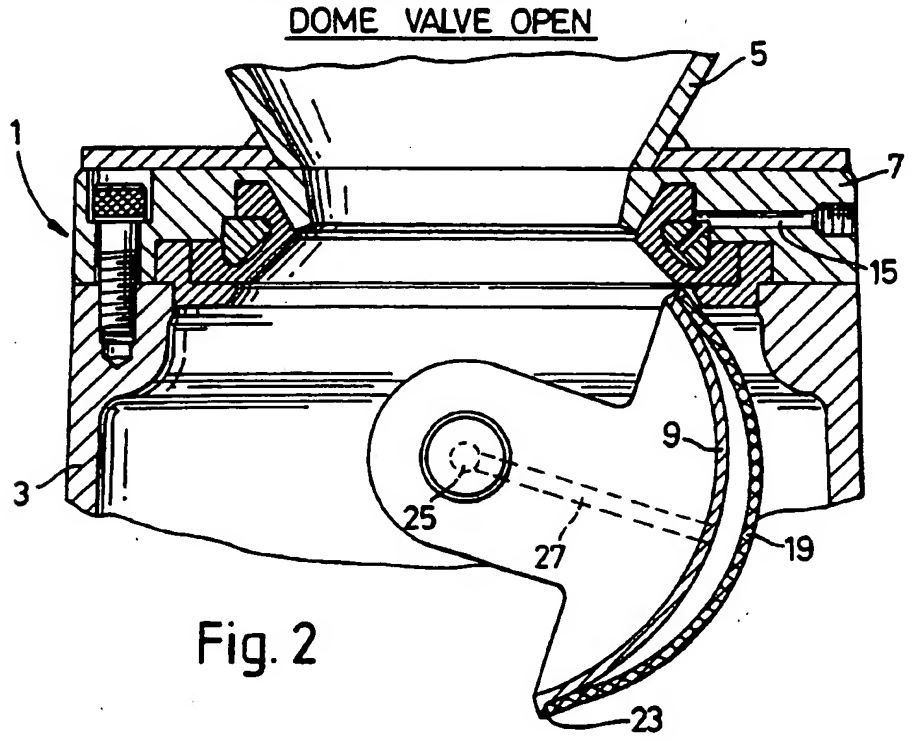

Fig. 2

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

DOME VALVE CLOSED

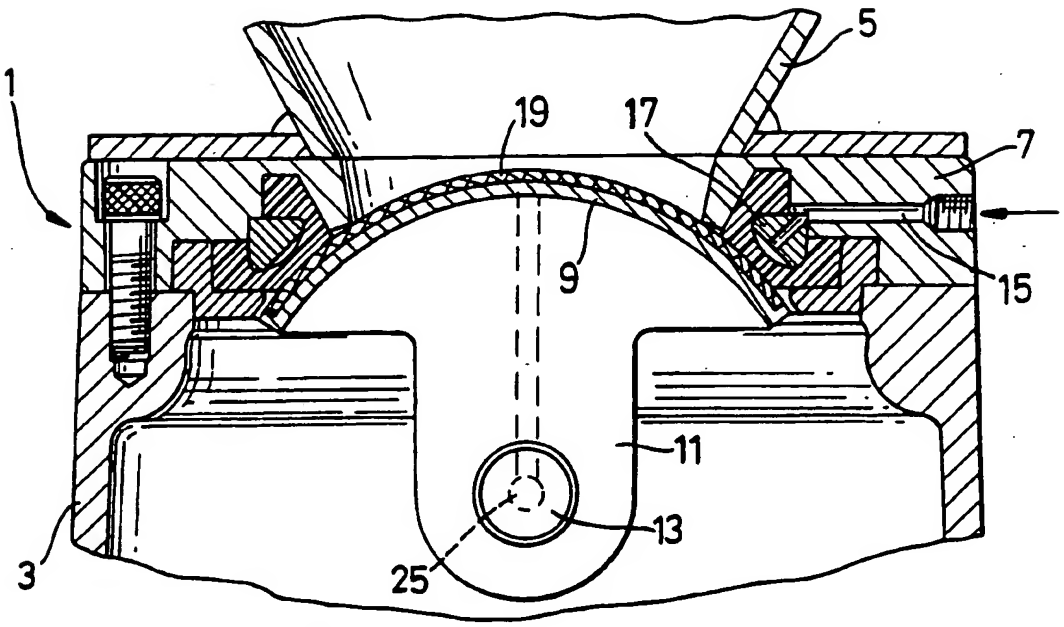

Fig.1

DOME VALVE OPEN

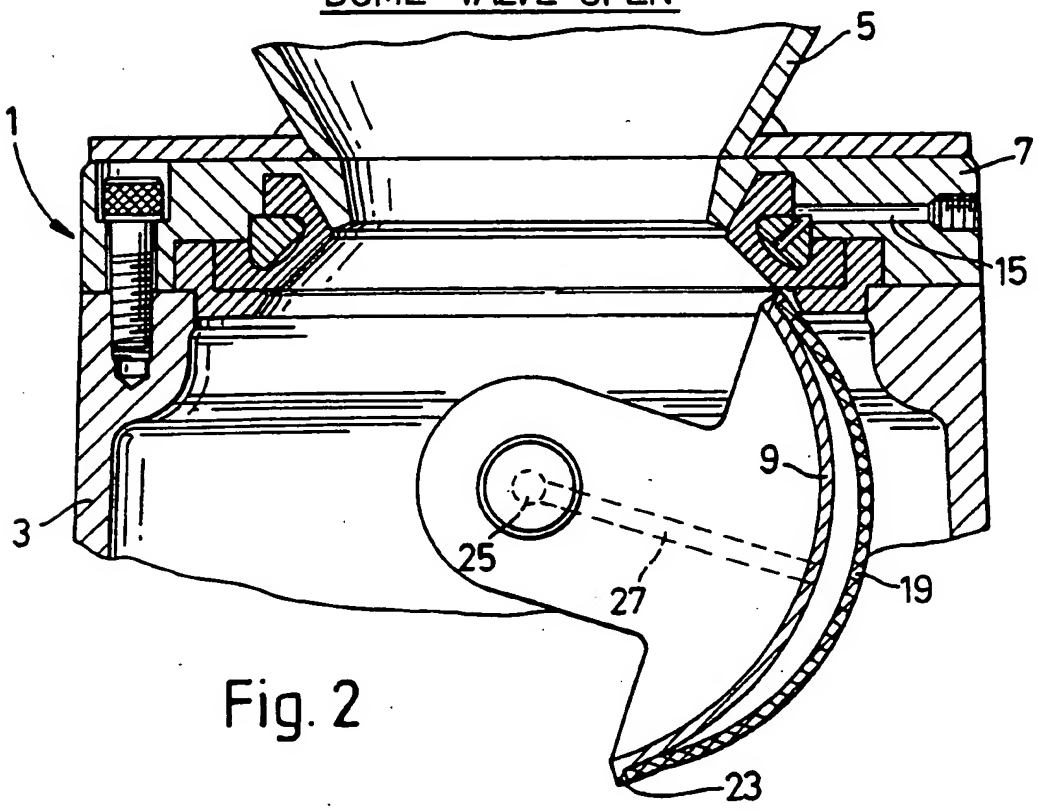

Fig. 2

VALVE ASSEMBLY

This invention relates to valve assemblies and in particular to valve assemblies for controlling the movement of flowable, solid or partly solid material in bulk, especially large, granular dry material. Such material may be required to be moved from one point to another, for instance, along a pipeline to a processing station for the material. In some position it may be desirable to interupt the flow of material, for instance, at the point where the material is required to enter a pressure vessel for subsequent pneumatic conveying or processing of the material within the pressure vessel.

In order to interupt the flow of material and/or to seal a pressure vessel or other equipment from the pipeline or other structure along which the material is being delivered, a valve assembly may be incorporated in the flow path of the material, for instance, between a pressure vessel and a pipeline or supply hopper. However, where the bulk material includes large, hard particles, particularly abrasive particles, it is difficult to close and at the same time seal an aperture because these large particles tend to obstruct the movement of the valve member or prevent the sealing of the valve member against the valve body when the valve member is in its closed position. To overcome such a problem, two separate valves have been provided, the first valve stopping the supply of the material and the second valve, provided downstream from the first valve, achieving an airtight seal across an aperture at which no material is present.

A further proposal involves a valve assembly including a closure member having the shape of a part of a spherical shell (dome shaped) rotatable about its spherical axis. The closure member may be made of a robust construction so that it may be driven through a column of material which may include large particles of hard, abrasive material.

Alth ugh a valve assembly with a dome shaped closure member has proved particularly useful in dealing with granular material, there is still a particular pr blem where the material has some adhesive character. Such materials may form a hard compressed deposit on the convex surface of the closure member under pressure. Attempts have been made to avoid this happening by providing a smooth, polished surface to the closure member so that materials have difficulty sticking to it and thereby building up on this surface. However with certain materials and under certain conditions this procedure is not sufficient to provide material build-up.

According to the present invention there is provided a valve assembly for closing and sealing an inlet which is full of granular material, the valve comprising a housing defining the inlet and defining an outlet, a closure member having the shape of a part of a spherical shell and being mounted for rotation between a first position in which the inlet is open and a second position in which the inlet is closed, the axis of rotation passing through the centre of the sphere of which the closure member forms a part, the closure member being provided with a flexible film or skin overlying at least part of its convex surface, and means for deforming at least a part of the flexible skin or film away from the convex surface of the closure member in order to dislodge any material adhering to the member.

Preferably, the valve housing is provided with an annular recess within which is mounted on deformable, resilient sealing ring. Gas supplied to the recess, while the closure member is in its second position, causes the centre of the sealing ring to deform out of the recess into engagement with the convex surface of the closure member to provide a gas-tight seal across the inlet.

Preferably the flexible skin or film is in the f rm of an elastomeric material covering essentially the ntir conv x surfac of the closure member and being bonded to it along or adjacent t the edge or edges of the closure member.

Preferably the flexible skin or film is deformed by means of compressed gas fed to a position between the normal rigid surface of the closure member and the flexible skin or film.

Preferably the compressed gas is compressed air and it is fed to the region of the closure member within a drive shaft associated with that closure member.

Accordingly, the present invention involves the application of a flexible movable surface to the normal hard surface of the closure member, the direct application of a flexible material to a moving valve part being a quite different approach to solving the problem of preventing material build-up that eventually causes jamming of the valve or valve leakage. In practice material builds up on the closure member over a period of time. Successive layers of fine material build up in a hard skin on the surface of the closure member and in particular where the existing inflatable seal presses against the convex surface of the closure member. In operation a valve assembly in accordance with the present invention is such that the closure member may be rotated to a position where the flexible skin or film is itself not restricted by any other part of the valve assembly and this skin or film may then be deformed by means of compressed air to dislodge any material adhering to it.

An apparatus in accordance with the present invention will now be described by way of example only, and with reference to the accompanying drawings, in which:-

- Figure 1 is a view of part of a valve assembly in accordance with the present invention, mainly in a vertical section; and

- Figure 2 is a similar view of the valve assembly of Figure 1 but with the closure member shown in an open position.

Referring to the drawings, a valv assembly 1 is mounted between a pr ssure vessel 3 and a material supply hopper 5. Only the top of the pressure vessel 3 is shown in the drawings but the pressure vessel also includes a material outlet and means for supplying compressed air to the interior of the vessel. Material may be delivered from hopper 5 to pressure vessel 3 and then expelled therefrom by means of compressed air.

Valve assembly 1 includes a valve housing 7 defining an aperture through which material passes between hopper 5 and pressure vessel 3.

Valve assembly 1 includes a dome shaped closure member 9 which has, integral therewith, two downwardly, diametrically opposed extensions, one of which 11 is shown in the drawing. These extensions allow the dome shaped member to be mounted on a drive shaft 13 and opposed pivot shaft (not shown). Rotation of drive shaft 13 by means of a motor (not shown) causes closure member 9 to move from its closed position as shown in Figure 1 to an open position shown in Figure 2. Accordingly the closure member rotates through 90° between its closed and open positions. The arrangement of the drive and pivot shafts relative to the valve member and the degree of movement of the valve member means, when the closure member is in its open position, the path of movement for material passing between hopper 5 and pressure vessel 3 is entirely unrestricted by the closure member or its driving arrangement.

When closure member 9 is in its closed position, compressed air may be supplied along bore 15 to an annular ring 17 at that side of the ring remote from closure member 9. The compressed air urges ring 17 into sealing contact with the closure member 9.

The surface of annular ring 17 which engages cl sure member 9 has a width such that any small particles which are trapped between ring 17 and closure member 9 will be entirely encl sed and will not normally affect the efficiency of th seal

between the ring and closure member. However in certain circumstances and with the use of sticky or adhesive materials, it is possible for fine material to build up in a hard skin on the convex surface of the closure member 9 and in particular where the inflatable seal 17 presses against the closure member. The closure member 9 is provided with an elastomer skin 19 on its convex or outer surface, this skin being bonded to the rigid normal closure member around the edge of the closure member, the closure member being provided with an outer circumferential lip 23 against which the edge of the elastomer skin abuts. Bonding takes place at this point of abutment and also for a short distance radially inwardly of lip 23.

Compressed air is feedable to the closure member along a central bore 25 located in drive shaft 13. The compressed air may be led along a further bore from drive shaft 13 up extension 11 via inflation air channel 27 to a position opening out on the external convex surface of closure member 9 so that the air may be fed between this surface and the elastomer skin.

When the closure member is in the closed position as shown in Figure 1, the resilience of elastomer skin 19 will cause it to lie in close contact with the rigid outer surface of the normal closure member. However when the closure member is moved to its open position as shown in Figure 2 and compressed air is fed to the convex surface of the closure member, the elastomer skin is caused to deform to the position shown in Figure 1, that is to say, away from the rigid convex surface apart from at its edges where it is bonded to the closure member. This deformation or deflection will cause any hard compacted material adhering to the closure member to be dislodged, thereby preventing any build-up of material on the closure member, particularly in the region where the inflatabl seal 17 pr sses against the closure m mber 9.

CLAIMS

1. A valve assembly for closing and sealing an inlet which is full of granular material, the valve comprising a housing defining the inlet and defining an outlet, a closure member having the shape of a part of a spherical shell and being mounted for rotation between a first position in which the inlet is open and a second position in which the inlet is closed, the axis of rotation passing through the centre of the sphere of which the closure member forms a part, the closure member being provided with a flexible film or skin overlying at least part of its convex surface, and means for deforming at least a part of the flexible skin or film away from the convex surface of the closure member in order to dislodge material adhering to the member.

2. A valve assembly according to Claim 1 in which the valve housing is provided with an annual recess within which is mounted a deformable, resilient sealing ring.

3. A valve assembly according to Claim 1 or Claim 2 in which the flexible skin or film is in the form of an elastomeric material covering essentially the entire convex surface of the closure member and being bonded to it along or adjacent to the edge or edges of the closure member.

4. A valve assembly according to any of the preceding claims in which the flexible skin or film is deformable by means of compressed gas fed to a position between the normal rigid surface of the closure member and the flexible skin or film.

5. A valve assembly according to Claim 4 in which the compressed gas is compressed air which is fed to the region of th closure member within a drive shaft associated with that closure member.

6. A valve assembly according to Claim 1 and substantially as described herein.

7. A valve assembly for closing and sealig an inlet which is full of granular material, substantially as described with reference to the accompanying drawings.

Patents Act 1977 Examiner's report to the C mptroller under Section 17 (The Search report) -5-	Application number GB 9313030.0
Relevant Technical Fields (i) UK Cl (Ed.M) B8S (SAG, SAH); F2V (VP102, VP15, VW17, VW48) (ii) Int Cl (Ed.5) B65D 90/54, 90/56, 90/58, 90/60, 90/62, 90/64, 90/66; F16K 13/02, 51/00	Search Examiner ALEX LITTLEJOHN Date of completion of Search 23 SEPTEMBER 1994
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASES: WPI	Documents considered relevant following a search in respect of Claims :- 1 TO 7

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A	GB 2134220 A	(BADHAM) see especially Figures 4 and 5	-
A	US 4489862	(DIEM) see eg column 6 lines 8 to 43	-
A	US 3916949	(ARMSTRONG) see whole document eg column 3 lines 57 to 63	-

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